

## Hispanic Children With Asthma: Morbidity

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**ABSTRACT.** Hispanic children represent a large and growing segment of the poor and disadvantaged children in our country. Asthma and other chronic respiratory diseases have a significant impact on poor children. Yet there are few descriptions of the specific morbidities and barriers to health that Hispanic children with asthma encounter, and data on predictors of morbidity among these children are unavailable. The purpose of this study is to describe the morbidity associated with asthma in Hispanic children and to identify factors that predict morbidity. A group of Hispanic children with moderate asthma followed in the clinics of the University of Texas Health Science Center at San Antonio were studied. Children aged 6 to 16 years with at least two acute-care visits or one hospitalization for asthma during the previous year were enrolled. Data sources included standardized questionnaires, spirometry, medical records, and school attendance records. Seventy-eight Hispanic children were enrolled in the study (mean age =  $9.4 \pm 2.7$  [SD]; 62% male). Fifty-two (67%) of children had been hospitalized previously. The other morbidity variables (mean  $\pm$  SD) were number of days/week impaired ( $1.1 \pm 1.2$ ), number of days absent from school per year ( $13 \pm 9.6$ ), number of acute-care visits per year ( $3.3 \pm 2.4$ ), and number of hospital admissions per year ( $0.6 \pm 0.8$ ). The mean forced expiratory volume in 1 second/forced vital capacity was  $79.3\% (\pm 9.1)$  and the mean forced expiratory flow, mid-expiratory phase, percent predicted was  $69.9\% (\pm 25.1)$ . Thirty-four children (44%) were exposed to cigarette smoke in the home. Parents answered an average of  $86\% (\pm 12\%)$  of questions about asthma correctly, but they made more errors in answering medication questions. Mean Impact-on-Family score was high ( $45.6 \pm 6.4$ ). Multiple regression analysis showed that Total Impact-on-Family scores were significantly increased if there was a smoker in the household and decreased when knowledge about asthma was high. Spirometry results ( $n = 45$ ) did not predict any of the morbidity variables. This study identifies two factors associated with morbidity in Hispanic children with asthma that must be addressed in an intervention program: knowledge about asthma and parental smoking in the home. *Pediatrics* 1993;91:62-69; asthma, morbidity, Hispanic American, Mexican-American, respiratory function tests, health services research, health behavior, smoking.

**ABBREVIATIONS.** FVC, forced vital capacity; ATS, American Thoracic Society; FEV<sub>1</sub>, forced expiratory volume in 1 second; FSIIR, Functional Status Measure; FEFR<sub>25-75%</sub>, forced expiratory flow, mid-expiratory phase.

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Asthma is a significant health problem that affects 7% of children aged 3 to 17 years and results in 28 million disability days per year for children younger than 17 years of age.<sup>1,2</sup> Childhood asthma is a major reason for health service utilization, resulting in more than 3.4 million patient visits and 149000 hospitalizations per year.<sup>3,4</sup> Asthma is a costly disease for children and their families. One study found that an average of 6.4% of yearly family income was spent in caring for a child's asthma and that low-income families spent more than 10% of their yearly family income for the same.<sup>5</sup> The illness of a child with asthma also has a substantial effect on the family's activities and future plans.<sup>6</sup> School absenteeism is high. Children with asthma miss an average of 8.4% of school days, a significant increase over their non-asthmatic classmates.<sup>7</sup>

Despite abundant information about asthma in general, little is known about this disease in Hispanics. The prevalence of asthma in this population is comparable to that in non-Hispanic whites (Anglos).<sup>8,9</sup> However, the morbidity of asthma among Hispanic children may be greater because of poverty, lack of insurance, cultural and language barriers, and health beliefs.

Children in the lower socioeconomic classes, which include many Hispanic children, experience an excess of severe asthma and a greater degree of functional morbidity.<sup>6</sup> Hispanic patients have lower rates of health insurance than patients from other racial and ethnic groups.<sup>10</sup> They also experience cultural and language barriers to health care.<sup>11,12</sup> Parents of asthmatic Mexican-American children are less likely than non-Hispanic white parents to believe that their child has asthma and are more likely to use emergency department services as a primary source of care.<sup>13</sup>

The objectives of this cross-sectional study were to (1) describe the morbidity present in Hispanic children with asthma; (2) describe the knowledge, health practices, and perceived barriers to health care of these children and their families; and (3) identify factors that predict morbidity. This study is important because it provides detailed information about the needs and health status of a group of Hispanic children with asthma and identifies potential areas for intervention.

### METHODS

#### Study Population

Children with asthma were identified from a registry of all patients 6 to 16 years of age who received emergency care or were hospitalized for asthma in the facilities of the Bexar County Hospital District between November 1988 and November 1989. This registry was created by reviewing written logs of emergency de-

partment and acute-care facilities and hospital discharge records for a diagnosis of "asthma" or "reactive airway disease." The Bexar County Hospital District facilities are the major clinical sites for the University of Texas Health Science Center at San Antonio and serve a population that is 80% Mexican-American. Pediatric patients receive care from pediatric residents, other rotating residents (family practice and psychiatry), and medical students under the supervision of pediatric faculty members. These patients are mostly urban, indigent, and pay for medications and medical care on a sliding-fee scale.

Children eligible for this study had physician-documented asthma as defined by the American Thoracic Society<sup>14</sup> (ie, several previous episodes of airway obstruction, demonstrated clinical response to bronchodilators, and no other known pulmonary disease). Eligible children had at least two acute-care visits or one hospitalization for asthma during the year covered by the registry. Eligible children were contacted by telephone, by letter, and by personal invitation at the time of any scheduled outpatient visit. An attempt was made to enroll all children who met the eligibility criteria. All medical records were reviewed by a single registered nurse trained by the principal investigator (P.R.W.). Chart review data were used to compare study participants to "nonenrollees" and to patients who refused enrollment ("refusals").

Ethnic group membership was defined by self-identification using the US Census identifier<sup>15</sup> or, in the case of nonenrollees, by medical record data. The results reported here are limited to Hispanic participants. This study was approved by the Institutional Review Board of the University of Texas Health Science Center at San Antonio.

## Procedure

After obtaining the parent's informed consent, a bilingual interviewer obtained information from the parent accompanying the child. Interviews were conducted in either Spanish or English, according to the parent's preference. The parent interview took approximately 45 minutes. Children were interviewed by a bilingual research nurse in a separate room. A single children's version in English of the Asthma Questionnaire was used. The child interview took 10 to 15 minutes. The interviewer and the research nurse were trained by the principal investigator, who periodically monitored interviews. Additional data were obtained by review of school attendance records and medical records. Medical visits were counted as acute-care visits for asthma only if the child received medical treatment (usually nebulized albuterol).

## Spirometry

Forced vital capacity (FVC) maneuvers were performed on all children during scheduled visits. Spirometry was not done if the child had experienced an acute exacerbation of asthma requiring treatment by a physician in the previous 2 weeks. No attempt was made to control for bronchodilator use before spirometry. All measurements were made with a dry rolling seal spirometer (S & M Instruments, Doylestown, PA). Spirometric results were included in the analyses if a child completed three FVC maneuvers that met the acceptability criteria of the American Thoracic Society (ATS).<sup>16</sup> The FVC measurement with the largest sum of FVC and forced expiratory volume in 1 second (FEV<sub>1</sub>) was converted to body temperature pressure standard and used for analysis. The percent of predicted spirometric variable values for gender and height were calculated using the equations for Mexican-American children reported by Hsu et al.<sup>17</sup>

## Questionnaires

The Asthma Questionnaire is a 50-item instrument developed by the investigators. It asks specific questions regarding knowledge and beliefs about asthma and medications, health behaviors, patterns of health care, morbidity, and sociodemographic information. The children's version of the Asthma Questionnaire is a shorter instrument, which parallels the parent questionnaire. A Spanish-language version of the Asthma Questionnaire (parent version) was developed using translation and back-translation by local bilingual personnel. Deyo and coworkers' four-item language-based acculturation scale, which has been shown to be valid and reliable in a similar population, was used to measure acculturation.<sup>18</sup>

The Functional Status Measure (FSMR) is a 14-item instrument that measures the child's capacity to perform age-appropriate tasks in a variety of areas. The "illness score," which measures the

child's level of functioning as it relates to the child's illness, was used in the analyses. Both Spanish and English versions have been shown to be reliable and valid in other studies.<sup>19-21</sup>

The Impact-on-Family Scale consists of 27 items that assess the impact of the child's illness on several dimensions of family functioning. Both Spanish and English versions have been shown to be reliable in previous studies.<sup>20,22</sup> The Total Impact score was used in the analyses.

All Spanish-language instruments were pretested and minor changes in wording were made to adapt to local language use.

## Scales and Indices

Scales were developed for each of the following constructs: morbidity, personal and family history of asthma, child's health behaviors (self-report), child's health behaviors (parent's report), and barriers to health care. For these constructs, scale scores were computed using summed responses from more than one questionnaire item. Items that decreased reliability were dropped from the scale. For example, the following 13 variables were combined to form the morbidity scale: previous hospitalization, "severe episode," current steroids, perceived severity, health compared to others, ability to play, number of days impaired per week, number of days absent per year, number of acute-care visits per year, and the four variables in Table 1. These variables were selected from an original list of 26 items.

Acculturation score, parental educational level, and income (household income/number of household members) were summed to give a sociocultural-economic status index. Finally, four indices were developed: knowledge of asthma, knowledge of prescribed medications, compliance, and avoidance of asthma triggers. For each index, component items were totaled and indexed from 0 to 1 to measure the proportion of desirable responses for each subject.

## Statistical Methods

Data are given with the standard deviation unless otherwise noted. Categorical data for enrollees were compared with those of "nonenrollees" and "refusals" using  $\chi^2$ .<sup>23</sup> Numeric variables were analyzed using one-way analysis of variance with post hoc, two-tailed Dunnett's multiple comparison test, after checking residuals for normality and influence.<sup>24,25</sup>

Simple bivariate relationships are described with  $\chi^2$  contingency tables for categorical measures. Parent and child questionnaire results were analyzed with the applicable choice of paired  $t$  test, Satterthwaite approximate  $t$  test, Wilcoxon signed-rank test, or  $\kappa$  statistic for agreement.<sup>26</sup> The outcome variables of morbidity score, illness score,<sup>18</sup> total Impact-on-Family score,<sup>20</sup> number of school days missed, number of acute-care visits per year, and number of days per week impaired were individually regressed on multiple predictor variables with backward elimination. The predictor variables were the following: history, sociocultural-economic status, child's health behaviors (self-report), child's health behaviors (parent's report), avoidance of asthma triggers, barriers to health care, knowledge of asthma, knowledge of prescribed medication, medication compliance, age, gender, FEV<sub>1</sub>/FVC, and forced expiratory flow, mid-expiratory phase (FEF<sub>25-75%</sub>).

The final set of predictor variables significant at  $P \leq .10$  from the multiple regression were subsequently analyzed as a reduced set of predictors. This allowed verification of the prediction equation with a slightly larger sample size. The final regression equations include variables significant at the .05 level. With 45 subjects there is at least a .94 power for detecting correlations as small as .50.

TABLE 1. Morbidity\* (n = 78)

Variable	Mean	SD	Range
No. of hospital admissions per year	0.6	(±0.8)	(0-3)
No. of days hospitalized per year	1.3	(±2.7)	(0-14)
No. of asthma medications	2.8	(±1.4)	(0-6)
No. of days oral steroids per year	7.7	(±9.6)	(0-38)

\* The Morbidity Scale (13 items) consisted of number of days impaired per week, number of days absent per year, number of acute-care visits per year, the four variables listed above, and the following six categorical variables: ever hospitalized for asthma, "severe episode" (intensive care unit admission, loss of consciousness, seizure), current steroids, perceived severity, health compared to others, and ability to play. Reliability (Cronbach's  $\alpha$ ) = .56.

## RESULTS

### Study Population

One hundred seventy-five children were eligible to participate in the study, and their parents were called a mean of 1.7 times ( $\pm 1.95$ ; range: 0 to 9) by telephone. Letters were sent to the 35 (21%) families who had a disconnected telephone number. Of those contacted, 9 children refused to participate in the study ("refusals"), and 78 children were enrolled. Eighty-eight other children qualified for the study but were not enrolled ("nonenrollees"), because we were unable to contact them by telephone, by mail, or at the time of any scheduled outpatient visit. Based on chart review data, enrollees differed from "nonenrollees" in that the enrollees were older ( $9.9 \pm 2.7$  vs  $8.7 \pm 2.5$ ,  $P < .05$ ) and had more acute-care visits ( $3.3 \pm 2.4$  vs  $2.2 \pm 2.1$ ,  $P < .05$ ). Twenty-one enrollees (27%) compared with 5 nonenrollees (6%) had visited the allergy clinic at least once in the past year ( $P = .001$ ). Forty-five enrollees (58%) compared with 22 nonenrollees (24%) had at least one visit to the pediatric residents' continuity clinic in the past year ( $P < .001$ ). Enrollees had more total scheduled appointments in the past year than nonenrollees ( $1.4 \pm 0.1$  vs  $0.5 \pm 0.1$ ,  $P < .001$ ). Children who refused to participate were older than enrollees ( $12.5 \pm 2.3$  vs  $9.9 \pm 2.7$ ,  $P < .05$ ) and were hospitalized more days per year ( $4.1 \pm 5.2$  vs  $1.2 \pm 2.5$ ,  $P < .05$ ).

Forty-eight (62%) of 78 children enrolled were male; mean age was 9.4 ( $\pm 2.7$ ) years (range: 6 through 16). The families of these children were poor and the majority of parents (62%) had not completed high school. Sixty-three families (81%) had an annual household income of \$12000 or less. Fifty-five (71%) children had no health insurance and only 11 (14%) had Medicaid. Most children (78%) lived in two-parent households. Sixty-six households (85%) had four or more members. Seventy-five (97%) mothers and 72 (94%) fathers considered themselves to be Mexican-American. The remaining parents were Puerto Rican (3), Cuban (1), and other Hispanics (3). Seventy respondents (91%) were the child's mother, five were the father, and two were the maternal grandmother.

Thirty-one (40%) parents chose to answer questions in Spanish. Figure 1 shows the responses to the four items of the language-based acculturation scale. The mean score on this scale was 2.3 ( $\pm 1.2$ ; range: 0 to 4; Cronbach's  $\alpha = .65$ ), indicating that language-based acculturation was midway between English-only language use (a score of 4) and Spanish-only language use (a score of 0).

### Medications

Almost all children took medications daily for asthma. The average number of medications that these children received for asthma was 2.8 ( $\pm 1.4$ ; range: 0 to 6). Sixty-two children (79.5%) used aerosolized albuterol, 41 (52.6%) used theophylline, 31 (39.7%) used topical cromolyn, and 5 (6.4%) used topical corticosteroids, alone or in combination with other medications. Thirty-six children (46%) used any anti-inflammatory medication (cromolyn, topical steroids, or oral corticosteroids).

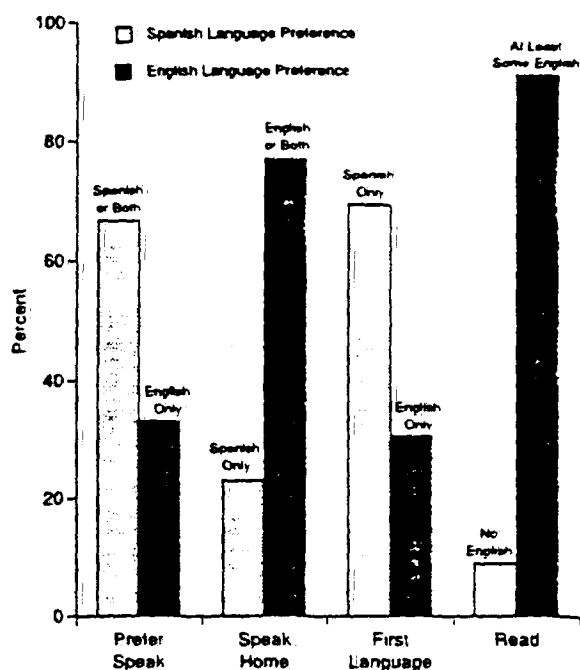


Fig 1. Language Use.

### Spirometry

A trained bilingual research nurse attempted to perform spirometry on 76 children. Two children were excluded because they had experienced an acute exacerbation within the previous 2 weeks. Sixty-five children (83%) produced at least one acceptable maneuver, but only 45 (58%) had three or more maneuvers that met ATS criteria for valid analysis.<sup>16</sup> The spirometric data of these 45 children demonstrated mild to moderate airway obstruction, with a wide range of observed values (Fig 2). The  $FEF_{25\%-75\%}$  of the children who completed three or more acceptable measurements was significantly lower than the  $FEF_{25\%-75\%}$  of the children with fewer than three acceptable measurements ( $69.9\% \pm 25.1$  vs  $86\% \pm 22.9$ ;  $P = .0001$ ). The  $FEV_1$ ,  $FEV_1/FVC$ , and peak expiratory flow rate did not differ significantly between the two groups.

### Morbidity

The rate of previous hospitalization (ever) for asthma was 67% (52/78). Twenty-six children (33%) had been admitted to an intensive care unit; three had experienced loss of consciousness, one had had a hypoxic seizure, but none had been intubated because of asthma. Eleven children (14%) were taking oral or topical corticosteroids at the time of the interview. Seventy-two parents (92%) stated that their child's asthma was somewhat serious (64%) or very serious (28%). Thirty parents (39%) thought that their child's health was not as good as other children's health. Fifty-eight (74%) of the children experienced at least occasional limitation in their ability to run and play.

Children experienced a mean of 1.1 ( $\pm 1.2$ ; range: 0 to 7) days of impairment per week, ie, days during which their sleep was disrupted by asthma symptoms or during which they were unable to participate

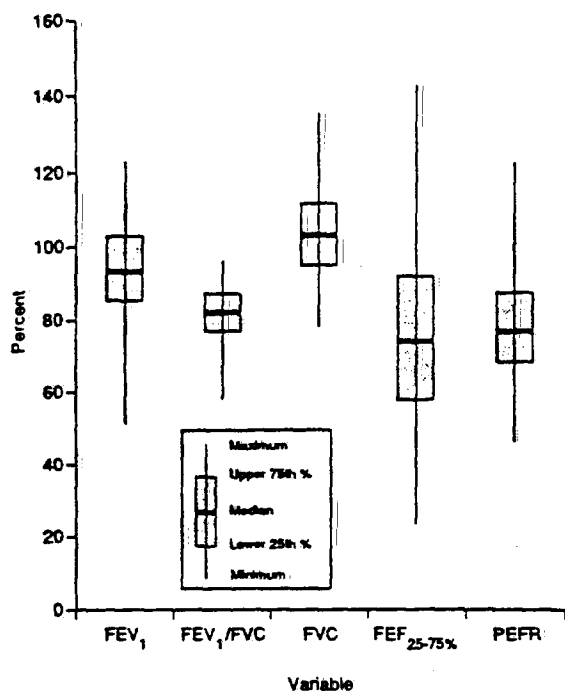


Fig 2. Spirometry ( $n = 45$ ). FEV<sub>1</sub>, forced expiratory volume in 1 second; FVC, forced vital capacity; FEF<sub>25-75</sub>, forced expiratory flow, mid-expiratory phase; PEFR, peak expiratory flow rate.

fully in usual activities (Fig 3, A). They were absent from school an average of 13 days ( $\pm 9.6$ , range: 0 to 51) in the previous year. This represents 7.4% of the 175 required days of school. Sixteen children (21%) missed 2 to 3 weeks of school and 25 (33%) missed 3 or more weeks of school (Fig 3, B). Children had an average of 3.3 ( $\pm 2.4$ ; range: 0 to 12) acute-care visits for asthma during the previous year (Fig 3, C). Other morbidity variables are shown in Table 1. Cronbach's  $\alpha$  for the morbidity scale (13 variables) was .56, with each item correlating .3 or higher with the total.

#### Barriers to Health Care

Ten (13%) children had no regular source of health care; they received routine care for asthma in the walk-in clinic or emergency department. Families of children with asthma experienced a mean of 2.14

( $\pm 1.35$ ; range: 0 to 4; reliability = .64) out of 4 potential barriers to health care for their child with asthma. The most frequently mentioned barrier was paying for medications (Table 2). This was not surprising, because few children had Medicaid or insurance and because families were billed for medications from the Bexar County Hospital District pharmacy on a sliding-scale basis. Cronbach's  $\alpha$  for the barriers scale was .64.

#### Health Behaviors and Attitudes

Table 3 contrasts the health behavior data from the parent's and child's versions of the questionnaire. Agreement between the answers of parents and children for some asthma care-related behaviors was modest ( $\kappa$ : .19 to .52). Thirty-two parents (42%) stated that they, and not their child, were the first to notice asthma symptoms. After listing their child's specific asthma triggers, parents reported that their children avoided a mean of half (0.50) of these triggers. Children reported significantly greater (0.73) avoidance of triggers. Parents reported significantly greater medication compliance than did their children. Parents reported a mean compliance of 0.89 on an index with a potential range of 0 ("never taken") to 1 ("always taken"), while their children reported a mean compliance of 0.75.

Thirty-four children (44%) were exposed to cigarette smoke in the home. Twenty-five (41%) fathers and 14 (18%) mothers living in the home were smokers. Forty-eight (67%) parents identified cigarette smoke as a trigger for their child's asthma. Twenty-four (71%) of the 34 families with a smoker in the home identified cigarette smoke as a trigger for their child's asthma.

Twenty-five (32%) parents had tried home remedies or over-the-counter medications to treat their child's asthma. The most common remedies were teas (16), cough syrups (4), and Primatene (5). However, only one parent believed that these remedies worked better than prescription medications for asthma. Three parents were unsure whether home remedies worked better. When asked to list actions taken when their child experienced an acute exacerbation of asthma, 65 parents (83%) mentioned giving asthma medications. Other commonly mentioned ac-

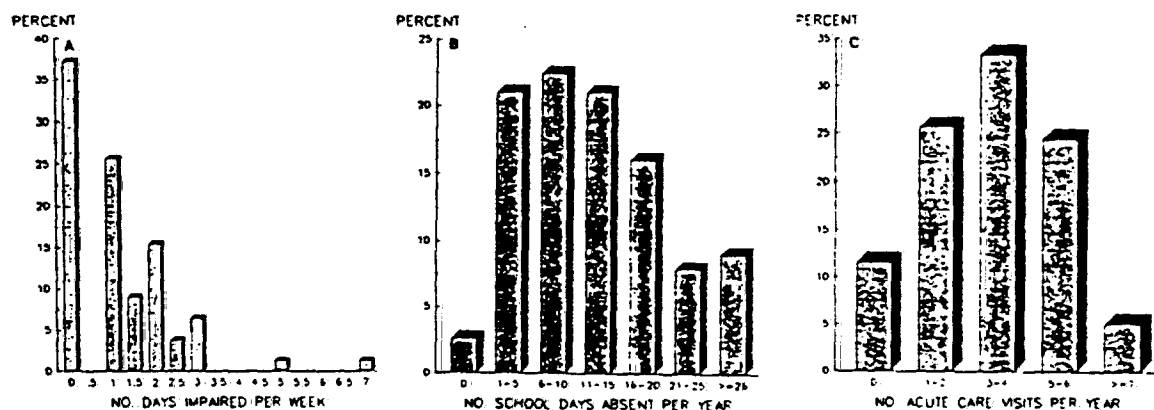


Fig 3. Frequency distribution of number of days of impairment per week (A;  $n = 78$ ), number of school days absent during the past year (B;  $n = 76$ ), and number of acute-care visits for asthma during the past year (C;  $n = 78$ ).

TABLE 2. Barriers to Health Care (n = 78)

Variable	No. (%) Reporting
No regular source of health care	10 (13)
Payment for medications*	57 (73)
Payment for visits*	45 (58)
Time of visit*	38 (49)
Transportation*	27 (35)
Giving medications in school	14 (18)

\* Items included in barriers scale (reliability = .64).

TABLE 3. Reported Health Behaviors (n = 78)

Behavior	Parent	Child	$\kappa$	P Value
Child takes medications on own some or all*	66%	56%	.32	.002†
Who notices asthma first: child, or parent and child*	56%	45%	.06	.289‡
Do anything to remember medications†	8%	12%	.19	.049‡
Avoid known triggers (index)†	.50	.73		.0003§
Compliance (index)†	.89	.78		.001§

\* Items included in Child's Health Behaviors (parent's report) scale.

† Items included in Child's Health Behaviors (self-report) scale.

‡ Significance level for agreement between parent and child responses, using  $\kappa$  statistic and one-tailed P value.

§ Significance level for differences between parent and child responses, using Wilcoxon's signed-rank test.

tions were taking the child to the doctor (78%) and calming the child (13%).

Twenty-six respondents (33%) had received advice about treating asthma from someone other than a physician. The advisor was usually a relative or friend. However, only eight (31%) of those who had received advice found it helpful.

#### Knowledge

The level of knowledge about asthma in this population was high. Parents answered an average of 86% ( $\pm 12\%$ ) of 11 questions about asthma correctly. Children answered an average of 69% ( $\pm 21\%$ ) of 11 questions correctly. Knowledge about asthma medications was also high. The most common errors were in frequency of administration. The only significant difference between parents' and children's knowledge about medications was in knowing the name of the medication. Children were often able to describe their medications but could not state the correct name. Parent and child responses are contrasted in Table 4.

#### Functional Status and Impact on Family

Functional Status scores (FSIIR) showed some impairment in functioning. The mean "Illness score"

TABLE 4. Knowledge About Asthma and Medications (n = 78)

Variable	Mean % Correct Responses		P Value*
	Parent	Child	
Asthma knowledge	86	69	.0001
Medication knowledge			
Name correct	79	55	.0001
Dose correct	69	65	.46
Frequency correct	59	51	.08

\* Significance level for differences between parent and child responses, using Wilcoxon's signed-rank test.

was 24.2 (86%) out of a possible perfect score of 28 for a child who is not impaired by illness (Cronbach's  $\alpha = .84$ ). The most frequently endorsed impairment due to asthma was "seems to feel sick and tired." Many parents also stated that their child "acts moody" and "seems unusually irritable or cross," but they were less likely to attribute these behaviors to their child's illness. Impact-on-Family scores indicated a moderate impact of the child's illness on the family. The mean raw Impact-on-Family score was 45.6 out of a potential maximum score of 76 (Cronbach's  $\alpha = .86$ ). Many parents agreed with the following statements: "The illness is causing financial problems for the family" (58%) and "Additional income is needed to cover medical expenses" (69%). Childhood asthma also resulted in disruption of family activities and plans. Parents frequently agreed with these statements: "We have to change plans about going out at the last minute" (55%) and "Sometimes I feel like we live on a roller coaster" (80%). Data for FSIIR and Impact-on-Family are shown in Table 5.

#### Regression Analysis

For multiple regression, each of the significant predictor variables has an effect that is independent of the others. With the full set of predictors, including  $FEF_{25\%-75\%}$  and  $FEV_1/FVC$ , backward elimination yielded no significant predictors of morbidity score, number of days absent from school, number of acute care visits per year, or illness score (FSIIR). The number of days with impairment per week was significantly predicted by history score (personal and family history of asthma and allergic disease). Total Impact-on-Family score was significantly higher if there was a smoker in the household and was lower when knowledge about asthma was high (Table 6).

#### DISCUSSION

This study documents the burden that asthma of moderate severity places on some Hispanic children and their families. We are aware that the results of this single study require replication and that several methodological issues need to be addressed before the results can be interpreted. First, this study was cross-sectional and was performed at a single site. The findings from this group of Mexican-American subjects may not apply to other groups of Hispanic children. Data from the Hispanic Health and Nutrition Examination Survey suggest that asthma may be more common and more severe in Puerto Rican children.<sup>9</sup> Whether this is due to actual differences be-

TABLE 5. Questionnaire Scores (n = 78)

Variable	Mean	SD	Range	Reliability*
Functional Status†				
Total Score	21.7	3.8	12-27	.76
Illness Score	24.2	3.9	14-28	.84
Impact-on-Family‡				
Total Impact	45.6	6.4	20-64	.86

\* Measured by Cronbach's  $\alpha$ .

† Functional Status (FSIIR) raw scores. Potential range = 0 to 28. Higher scores indicate better functional status.

‡ Total Impact score. Potential range of scores = 19 to 76. Higher scores indicate greater impact of the illness on the family.

TABLE 6. Linear Regression Analyses (n = 45)<sup>a</sup>

No. d/wk impaired = $-0.27 + 0.17$ (history)		
(R <sup>2</sup> = .22) (P = .0011)		
Total impact = $61.06 + 4.09$ (smoke) - $19.78$ (knowledge)		
(R <sup>2</sup> = .19) (P = .0315) (P = .0110)		

<sup>a</sup>History, personal and family history of asthma; smoke, smoker in household; knowledge, knowledge of asthma (index).

tween ethnic groups, to differences in living conditions (eg, urban vs rural), or to other factors is not known. Our enrollees were generally low-income patients who received care in a publicly funded health care system. Some of our findings may be attributable to problems associated with poverty. However, the socio cultural-economic status index was not a significant predictor of any of the outcomes in our study. Moreover, the morbidity experienced by our enrollees was quite similar to that reported previously for children from a broader range of socioeconomic levels.

Second, inasmuch as enrollment was limited to children who had experienced several acute-care visits or a hospitalization in the previous year, the findings cannot be generalized to other children with less severe illness. Representative community-based, cross-sectional surveys such as the Hispanic Health and Nutrition Examination Survey and the Child Health Supplement to the National Health Interview Survey are more appropriate sources of information about children with mild asthma. However, our enrollees represent a group of children who are important to study because their illness is a significant burden for the children and results in frequent utilization of emergency department and hospital services.

Third, although families were quite willing to participate if contacted, many families could not be contacted. Nonenrollees had fewer acute-care visits and fewer scheduled clinic visits. They may have been less sick than enrollees or they may have used health care facilities less frequently. Unfortunately, our data do not allow us to characterize this group further. The great difficulty that we had in contacting children with asthma who had received medical care in the previous year may also point to problems that low-income families have in accessing health care.

The rate (58%) at which children in this study completed FVC maneuvers that met current ATS criteria<sup>16</sup> deserves further comment because it is lower than the 86% rate (three acceptable FVC maneuvers in seven attempts) reported by Hsu et al<sup>1</sup> in normal 8- to 9-year-old children. There are several potential explanations for this difference. First are technical problems arising from the personnel who performed the spirometry or from the equipment. We believe this is an unlikely source of error because both personnel and equipment met the criteria put forth by the ATS.<sup>16,27</sup> A second possibility is that the rate was lowered by the inclusion of a significant number of younger children in our study (15% were younger than 7 years). Finally, the current criteria for acceptability and interpretation of FVC maneuvers may be difficult to meet for children with asthma. To our knowledge, these criteria have not been tested in groups of children of any age with lung disease.

Finally, the small sample size and relatively low reliability of some of the scales may have contributed to the small effects seen in the regression equations. We need to develop more specific measures of health behaviors, knowledge, barriers to health care, and morbidity.

As a group, our patients met the criteria for asthma of moderate severity proposed by the Expert Panel of the National Asthma Education Program<sup>28</sup> and were demographically similar to other groups of urban, Hispanic children.<sup>15</sup> These children experienced significant impairment in many areas of their daily lives, and the financial and personal cost of this disease was high. Certain health behaviors, barriers to health care, and prescribing practices were identified as potential targets for intervention.

Despite relatively low rates of hospitalization, these children experienced a high impact of asthma on their daily lives as measured by school absenteeism, days with impairment, exercise limitation, and acute-care visits. The rate of school absenteeism (13 of 175 days; 7.4% of total days) was similar to that reported by Parcel et al.<sup>7</sup> Other authors, using data from the 1988 Child Health Supplement to the National Health Interview Survey, have shown that children with asthma miss approximately twice as many school days as children without asthma.<sup>29</sup> The Child Health Supplement data and the study by Parcel et al.<sup>7</sup> included a cross-section of children from different socioeconomic groups who had asthma of varying severity. Their data and ours indicate a substantial effect of asthma on school attendance.

Functional status scores (FSIR) and Impact-on-Family scores were similar to values reported in other studies of chronically ill children and demonstrate the impact of asthma on the daily activities of children and their families.<sup>19,20</sup> In a study of inner-city, low- and middle-income children, Stein and Jessop<sup>19</sup> found that chronically ill children had lower functional status scores and more variation in scores than well children. Lewis et al.,<sup>21</sup> in a study of middle income children with asthma, found that parents were more likely to attribute certain types of impairment to illness than they were other types of impairment. Functional status scores and Impact-on-Family scores in our study were similar to those reported by Stein and Jessop and we observed that parents discriminate between different aspects of impairment, as described by Lewis et al. Because the effects of asthma are so pervasive, physicians should inquire about several aspects of day-to-day functioning, rather than focus solely on emergency department visits and hospitalizations. In children who were able to perform spirometry, pulmonary function variables did not predict any of the morbidity outcome variables, suggesting that other factors—behavioral and environmental—contribute to the impact of a chronic illness on children and their families.

Certain health behaviors, barriers to health care, and medical care factors may have contributed to the morbidity experienced by these children. Although parents reported high rates of compliance and perceived medication efficacy, reported avoidance of known asthma triggers was lower. Children and their parents differed significantly in some of their

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opinions and self-reported behaviors. These differences may result from real differences in the experiences, behaviors, and attitudes of parents and children; a limitation in the ability of children to understand certain questions; or other unknown factors. These differences bear further exploration.

Many children (44%) were exposed to cigarette smoke in their homes. Smoking rates were similar to rates found among Mexican-American subjects in the Hispanic Health and Nutrition Examination Survey.<sup>30</sup> ~~Because passive smoking has been shown to increase frequency of asthma symptoms and emergency department visits, these rates are worrisome.<sup>31</sup>~~

Most children with asthma experienced several barriers to optimal health care. Lack of insurance coverage, other financial barriers, and lack of a routine source of health care were common. According to data from the National Medical Expenditure Survey, Hispanic persons were more likely to be uninsured (25%) than non-Hispanic white or black persons (9% and 16%, respectively).<sup>10</sup> In view of the finding that 71% of our study participants did not have health insurance and that the majority were impoverished, it is not surprising that most families had concerns about paying for medications. Thirteen percent of children did not have a regular source of health care. Similarly, in the National Medical Expenditure Survey, Hispanic patients were less likely to have a usual source of health care than non-Hispanic white patients.<sup>32</sup> Lack of a consistent source of health care may pose a particular problem for children with a chronic disease, such as asthma.

Physician prescribing patterns also may have contributed to morbidity. Despite the severity of illness in these children, only half had been prescribed anti-inflammatory agents. Inflammation is now believed to be an important contributor to airway obstruction. The recommendations of the Expert Panel Report of the National Asthma Education Program<sup>28</sup> emphasize the use of anti-inflammatory agents for children with moderate or severe asthma. However, decisions to prescribe these medications must be tempered with an understanding of the high cost of inhaled cromolyn and steroids compared with topical  $\beta$ -agonists and oral theophylline. Indeed, paying for medications was the most common barrier reported by families in this study.

#### RECOMMENDATIONS

This study reveals several potential targets for intervention. Two factors, knowledge about asthma and exposure to cigarette smoke in the home, were significantly associated with outcome in these children and therefore should be addressed in interventions. Because increased knowledge about asthma was associated with a decrease in the impact of the illness on the family, and because knowledge is a necessary prerequisite for behavior change, intervention programs must address patient and family needs for information.

Passive exposure to cigarette smoke was a common finding and was significantly associated with impact of the illness on the family. Inasmuch as the success of smoking cessation interventions has been found to be related to both the number of sessions

and the duration of contact with the program, the ongoing relationship of a physician with the parents of a child with asthma may be a good forum for smoking cessation advice.<sup>33</sup> Although the effect of a single patient-physician encounter on smoking behavior is probably small, some authors have shown that asking a patient if he or she smokes resulted in a significant increase (4%) in sustained abstinence.<sup>34</sup> At a minimum, physicians should encourage children with asthma and their families to limit the child's passive exposure to cigarette smoke.

This study also reveals several problem areas in the care of children with asthma. In our study, these factors were not significantly associated with outcome. However, based on our findings and those of other authors, these recommendations seem reasonable for all children with asthma. Physicians, through educational and behavioral interventions, should be encouraged to increase use of anti-inflammatory agents. Efforts should be made to reduce financial and other barriers to health care and to shift chronic care from emergency departments to individual medical providers.

Asthma self-management skills are another potential target for intervention. Although no single behavior or group of behaviors was significantly associated with morbidity, this study revealed several potential problem areas. These families had problems with early symptom detection and with avoidance of triggers. In other studies, improved self-management skills have been associated with decreased morbidity from asthma.<sup>35</sup>

This study clearly describes the morbidity experienced by a group of Hispanic children with asthma, the possible contributing factors, and the potential targets for intervention. Future studies should focus on the development and evaluation of interventions that are tailored to the needs of this rapidly growing and at-risk group of children.

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## BARTHOLOMAEUS METLINGER ON TEETHING (1476)

Metlinger's *Ein Regiment der Jungen Kinder*, published in Augsburg in 1473, was the first German work on children to be printed in the vernacular. He described teething as follows<sup>1</sup>:

In many children the teeth come easily and with little distress but these fall out again. But when the teeth come up with difficulty and with great pains they are the more strong. Teeth come more easily in the spring, next in summer, and with the most difficulty in winter. When the teeth are trying to come, various disturbances occur in children such as swelling in the jaws and neck, and they stir up other ailments. If the jaws begin to swell, one should rub them with honey and salt, that takes away their pain and strengthens the jaw. And when the teeth have come through one should let the child chew the stem of violet or liquorice. And when the points of the teeth are coming through they are eager to chew and bite hard and one must be careful that they do not chew anything too hard, and one should rub their jaws with hare's brain or with hen's grease or with dog's milk: these have the property of making the coming of teeth easier and one may let them chew on soft violet root or liquorice stem.

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